Proposed Agreement between California Energy Commission and The Regents of the University of California, Berkeley

Title: Potential Energy Scenarios for California and Their Environmental Consequences: Phase Ia
Amount: $900,000.00
Term: 26 months
Contact: Guido Franco
Committee Meeting: 2/1/2011

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
09	Electric	EA	Global Climate Change	$4,323,000	$809,661	$0	0%
10	Electric	EA	CA Energy Futures	$800,000	$90,339	$709,661	89%

Recommendation

Approve this agreement with UC Berkeley to develop long-term energy scenarios for California using a geographical information system framework and high temporal resolution to properly model intermittent sources of electricity, in the amount of $900,000.00. The scenarios will provide information on the potential strategies that could be used to achieve the 2050 greenhouse gas emissions reduction goals. The environmental implications of these scenarios will be explored in a companion research project. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

Issue

The California energy system must change drastically in the next few decades in response to the mandate to reduce greenhouse gas (GHG) emissions by 2020, the requirement to substantially increase the contribution of renewables to the electricity mix, and the goal of reducing emissions by 80 percent by 2050. Studies focusing on reducing GHG emissions from the energy system usually focus on one or two aspects (e.g., the potential for energy efficiency in building) and on one or two sectors. An on-going PIER project ending by the summer of 2011 is exploring an integrated approach (all fuels, all sectors), but it has become abundantly clear that not taking into account the geographical location of the energy providers and the temporal availability of resources and demand can result in unrealistic projections on how the energy sector could evolve in California.

Given the fast pace of transformation of California's energy system, non-traditional power plant projects (e.g., offshore wind) proposals should be expected. To make sure that reducing greenhouse gas emission from the electricity system does not result in unintended environmental impacts, there is an urgent need to anticipate the potential evolution of the energy system and to start the investigation of the environmental implications of these potential energy scenarios and, as needed, collect environmental baseline data and to develop improved methods to track environmental changes.

Background

The Energy Commission's Research and Development Committee approved the design of an exploratory project to start addressing the issues described above. This is phase Ia of this project dealing with the evolution of the energy system while a companion study is being developed to address environmental issues (Phase Ib).

Proposed Work

The research team will use a newly developed model of the electricity system known as SWITCH (a loose acronym for Solar, Wind, Hydro and Conventional generation and Transmission Investment model) that is able to simulate the intermittent nature of renewable energy resource demands with high temporal and spatial resolution. SWITCH is a mixed-integer linear optimization program that combines the capabilities of capacity-expansion and hourly operational models by concurrently building and dispatching the optimal power system under different policy scenarios. The model's objective function is to minimize the cost of meeting projected electricity demand with generation, storage, and transmission from present day until 2050 subject to a capacity reserve margin, environmental and operational constraints, and both current and novel climate policies. The rest of the energy system (e.g., residential energy demand) will be accounted for using an enhanced version of the LEAP model that has been under development for PIER.

Several enhancements to the SWITCH model are planned, including sub-hourly simulations to better capture intermitent issues and in- depth comparison of the model with industrial grade short-term models used by electric utilities and the CalISO. The researchers will simulate several potential energy scenarios under different policy options (e.g., carbon prices or cap-and-trade programs).

Justification and Goals

This project "[will] advance energy science or technologies of value to California citizens..." (Public Resources Code 25620.(c)), and is part of a "full range of research, development, and demonstration activities that . . . are not adequately provided for by competitive and regulated markets (Public Resources Code 25620.1.(a)).

This project also addresses SB 1078, the Renewable Portfolio Standard, which requires the state's renewable energy share to be increased to 20% by 2017. The Energy Commission, along with California Public Utilities Commission, shares responsibility of implementing the program.

This will be accomplished by:

- Developing several potential energy scenarios under different policy options (e.g., carbon prices or cap-and-trade programs).
- Simulating the intermittent nature of renewable energy resource demands with high temporal and spatial resolution with the goal of minimizing the cost of meeting projected electricity demand with generation, storage, and transmission from present day until 2050.